

Setting CNC aspheric glass and diamond turning machines

Overview

This standard identifies the competences you need to set up computer numerical controlled (CNC) machines or CNC machining centres for the machining of aspheric glass and diamond turned components, in accordance with approved procedures. You will be expected to select the appropriate workholding devices, and to mount and secure them to the machine spindle. You will also be required to select the appropriate cutting tools, to mount and secure them to the appropriate tool holding devices, and to place the cutting tools in the relevant positions within the tool posts, turrets, slides or tool-change magazine/carousel, where this is applicable.

You will need to ensure that all the tools have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. You will also be required to produce tool path information for each set-up, and to edit where required. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes. You must produce trial components and prove that the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for the machine-setting activities undertaken, and to report any problems with the equipment, tooling, programs or setting-up activities that you cannot personally resolve, or that are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to the setting-up procedures used. You will understand the CNC turning machine used, and its application, and will know about the workholding devices, tooling, machine operating programs and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and for ensuring that the work output is produced to the required specification.

You will understand the safety precautions required when working with the machine and with its associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

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Performance criteria

You must be able to:

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1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. follow the correct specifications for the component to be produced
3. determine what has to be done and how the machine will be set to achieve this
4. mount, set and secure the required workholding devices, workpiece and cutting tools
5. set the machine tool operating parameters to achieve the component specification
6. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
7. produce trial/first-off components to prove the machine settings
8. complete the required production documentation
9. deal promptly and effectively with problems within your control and report those that cannot be solved

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Knowledge and understanding

You need to know and understand:

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1. how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. how to start and stop the machine in normal and emergency situations
3. the importance of wearing the appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
4. the hazards associated with working on CNC machines and how to minimise them and reduce any risks
5. how to handle and store cutting tools correctly
6. how to save the programs in the appropriate format, and the importance of storing programs and storage devices safely and correctly, away from contaminants and possible corruption
7. the methods and procedures used to minimise the chances of infecting a computer with a virus
8. the implications if the computer you are using does become infected with a virus and who to contact if it does occur
9. how to extract and use information from engineering drawings or data and related specifications (to include symbols and conventions to appropriate standards) in relation to work undertaken
10. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
11. the relationship between design and manufacture of aspheric components
12. the range of workholding methods and devices that are used on CNC machines
13. why it is important to set the workholding device in relation to the machine datums and reference points
14. the methods of setting the workholding devices, and the tools and equipment that can be used for this
15. the range of cutting tools that are used on CNC machines for aspheric glass and diamond turning operations, and their typical applications
16. how to check that the cutting tools are in a safe and serviceable condition
17. the various tool holding devices that are used, and the methods of correctly mounting and securing the cutting tools to the tool holders
18. how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data
19. how to conduct trial runs, using single block run, dry run and feed/speed override controls
20. why you would conduct a full dry run and single block run
21. the settings that you need to check before allowing the machine to operate in

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full program run mode

22. how the various types of material will affect the feeds and speeds that can be used

23. the application of cutting fluids with regard to the range of material being machined

24. typical problems that can occur with the setting up of the tooling and workholding devices, and what to do if they occur

25. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

Scope/range related to performance criteria

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1. Carry out all of the following during the setting-up activities:
 - 1.1 adhere to procedures or systems in place for risk assessment, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
 - 1.2 confirm that the correct operating program has been loaded
 - 1.3 obtain the correct tooling and check that it is in a safe and usable condition and appropriate to the operations to be performed
 - 1.4 ensure that components are correctly positioned and held securely, without damage or distortion
 - 1.5 update program tool data, as applicable
 - 1.6 position and adjust machine guards
 - 1.7 apply safe working practices at all times
 - 1.8 leave the work area in a clean and safe condition on completion of the activities
2. Prepare two of the following types of optical CNC machines in readiness for production:
 - 2.1 aspheric generating
 - 2.2 aspheric polishing
 - 2.3 diamond turning aspheric process
 - 2.4 diamond turning diffractive/hybrid process
3. Position and secure workpieces, using two of the following workholding methods and devices:
 - 3.1 chucks
 - 3.2 faceplates
 - 3.3 other specific workholding devices
4. Select and mount, in the appropriate tool holding device, three of the following types of cutting tool:
 - 4.1 form tools
 - 4.2 half radius tools
 - 4.3 roughing tools
 - 4.4 edging/step tools
 - 4.5 finishing tools
5. Prepare the tooling for operation by carrying out all of the following activities, as applicable to the machine type:
 - 5.1 mounting the tools in/on the correct tool holding device
 - 5.2 positioning tools in the correct position in the tool posts, turrets, magazine

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- or carousel (where applicable)
- 5.3 ensuring that the tools have a specific tool number in relation to the operating program
- 5.4 entering all relevant tool data into the operating program (tool lengths, offsets, radius compensation)
- 5.5 presetting tooling using setting jigs/fixtures (where appropriate)
- 5.6 setting tool datums
- 5.7 saving changes to the operating program
- 6. Make trial components to prove that the machine is operating to the required specification, and in compliance with one of the following standards:
 - 6.1 BS, ISO or EN standards and procedures
 - 6.2 customer (contractual) standards and requirements
 - 6.3 company standards and procedures
 - 6.4 other accepted international standards

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